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(54) **METHODS AND SYSTEMS OF SELECTIVELY ENABLING A VEHICLE BY WAY OF A PORTABLE WIRELESS DEVICE**

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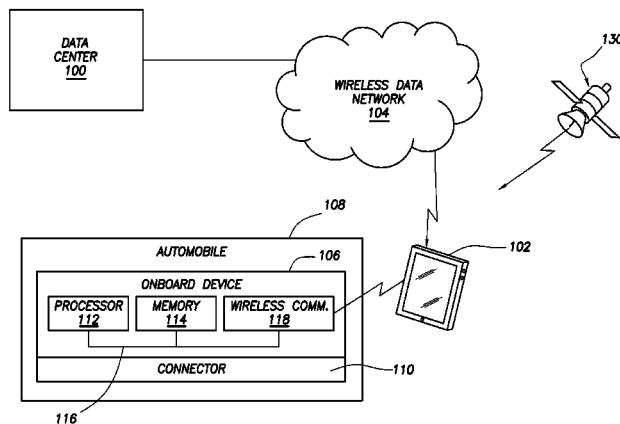
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ABSTRACT

Selectively enabling a vehicle by way of a portable wireless device. At least some of the illustrative embodiments are systems: a data center; a portable wireless device; and an onboard device affixed to a vehicle. The onboard device communicates to the data center by way of the portable wireless device. The portable wireless device programmed to: send a command to disable the vehicle to the onboard device by way of a first communication protocol; send a command to enable the vehicle to the onboard device by way of the first communication protocol; and send an indication of location of the vehicle to the data center over a second communication protocol.

6 Claims, 5 Drawing Sheets



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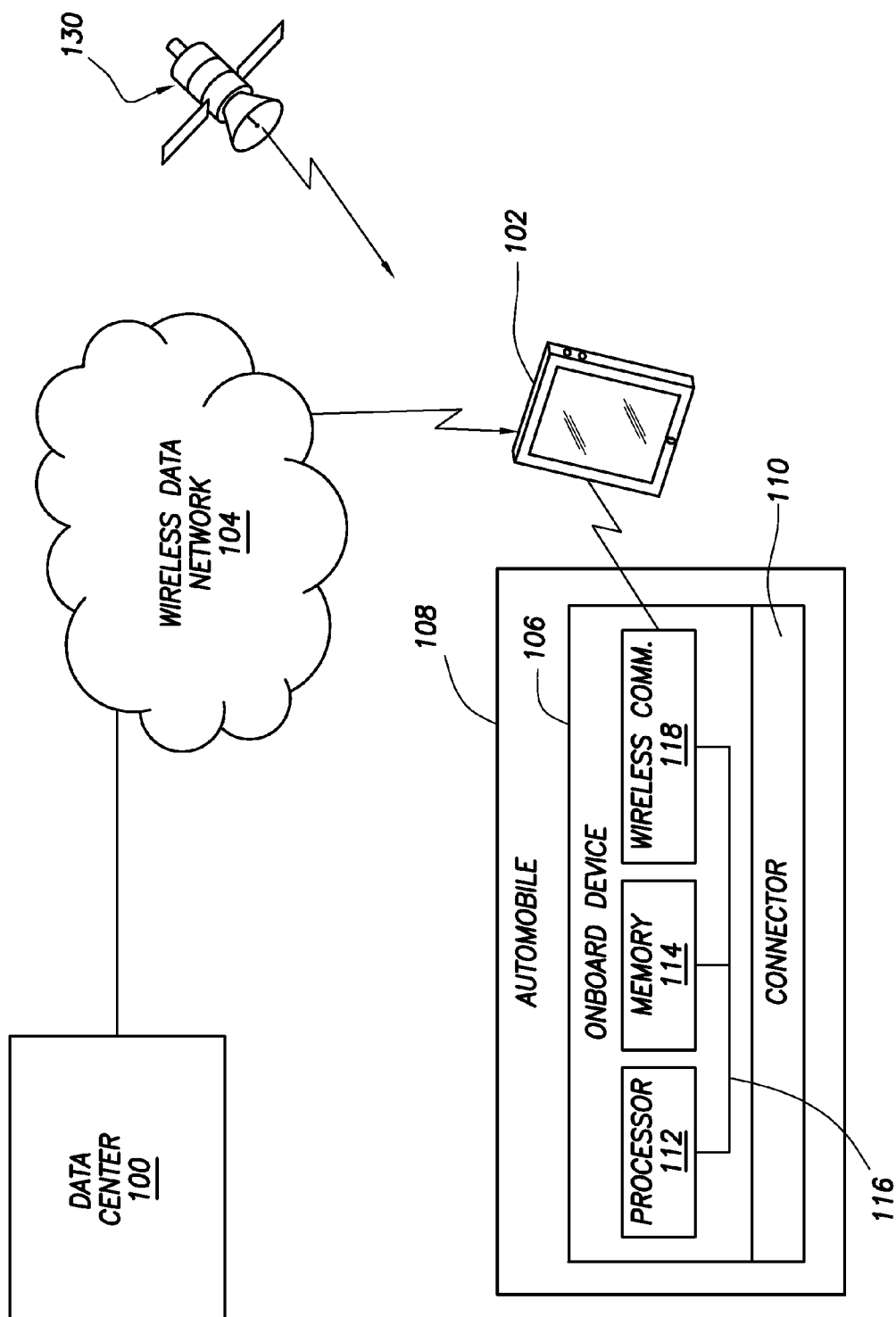


FIG. 1

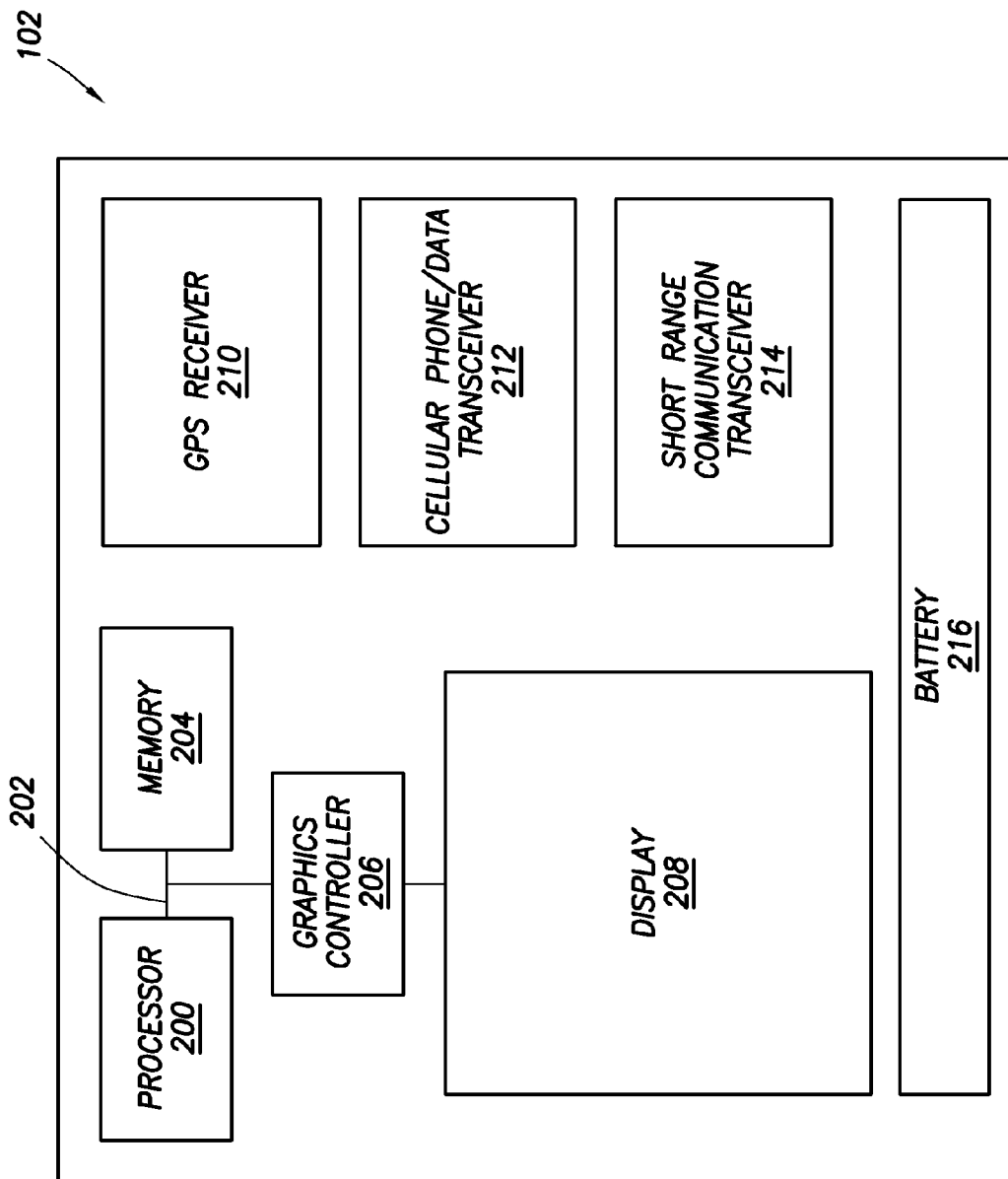


FIG. 2

FIG. 3

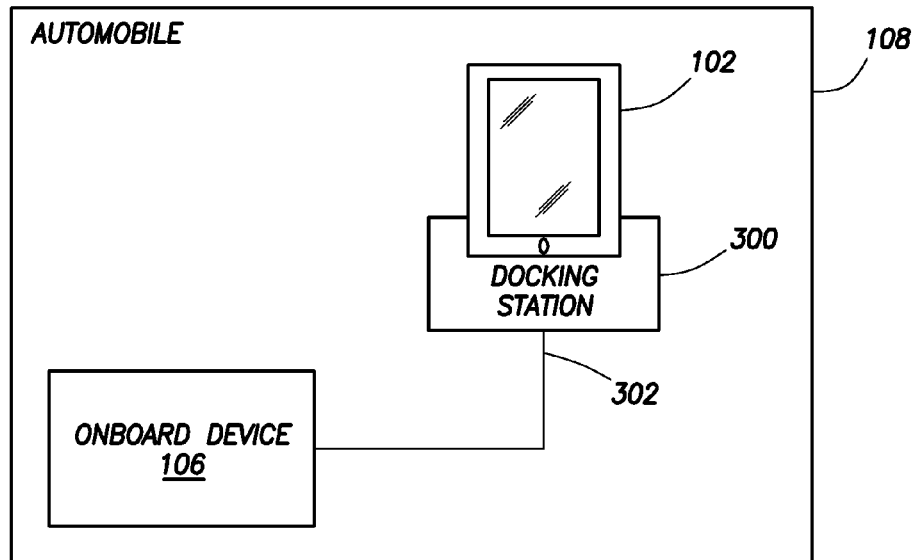
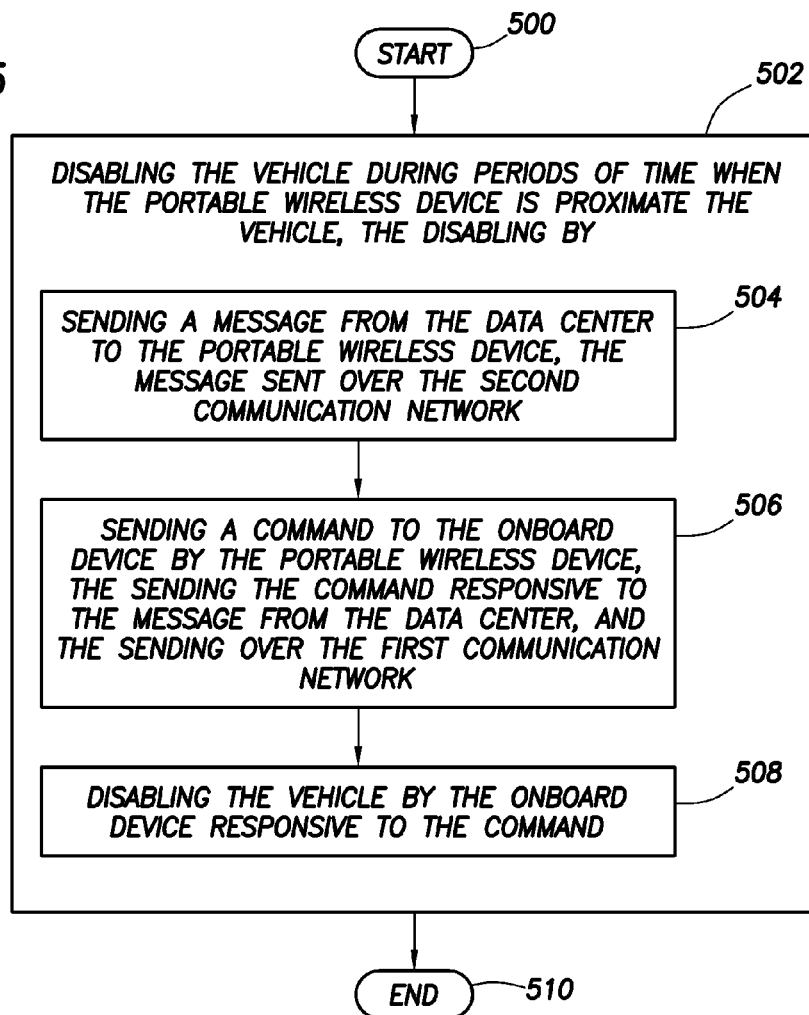


FIG. 5



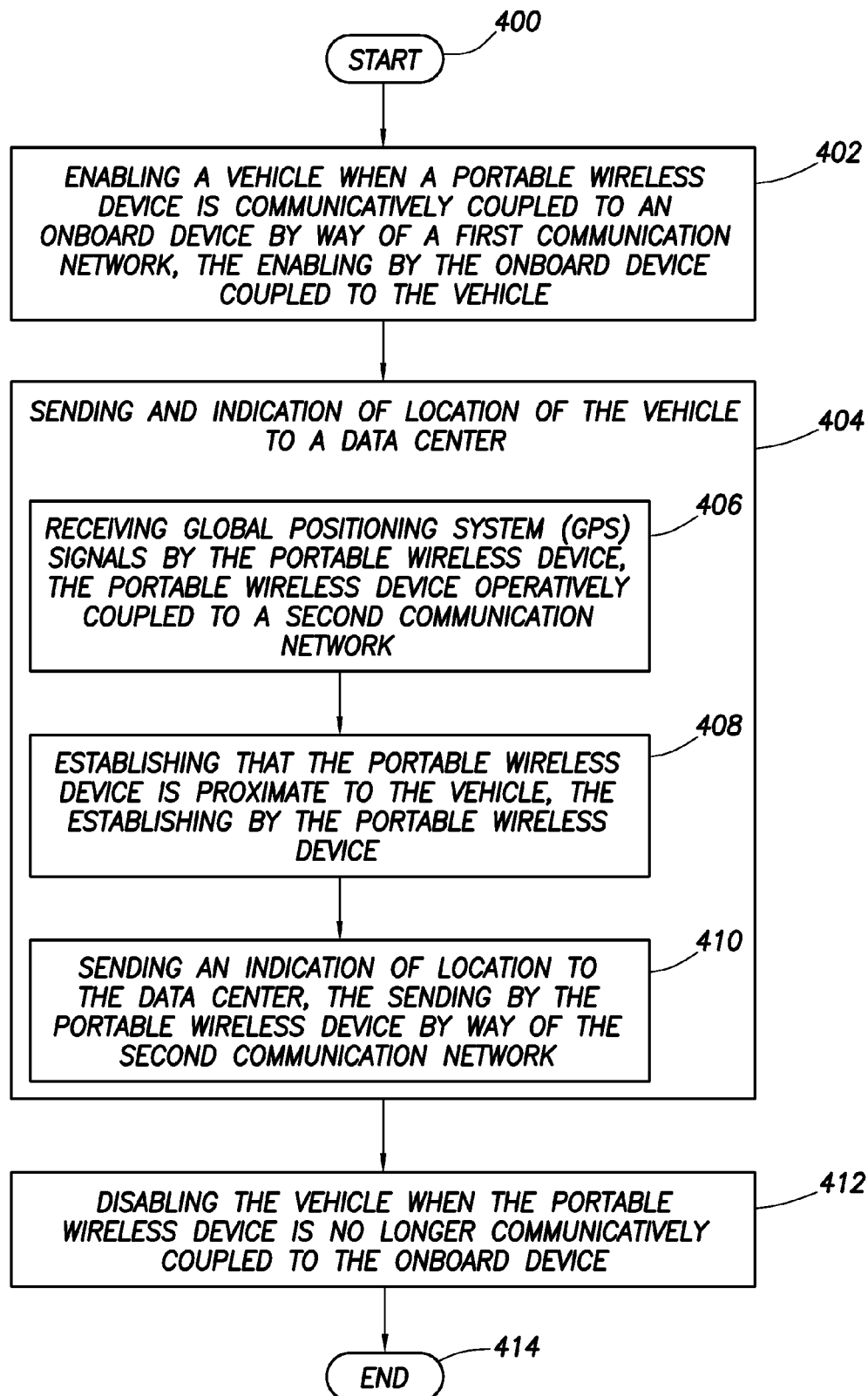


FIG. 4

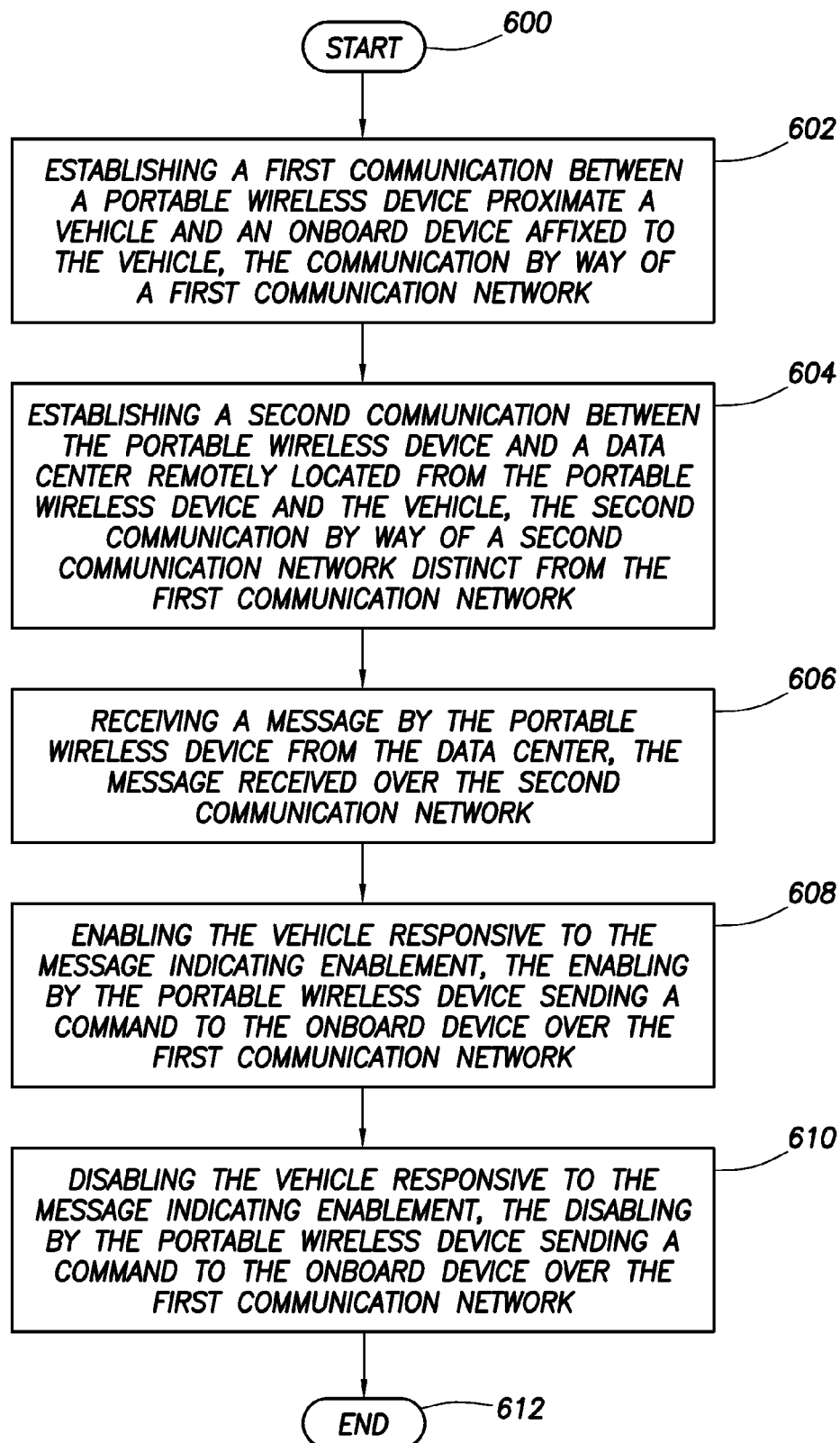


FIG. 6

METHODS AND SYSTEMS OF SELECTIVELY ENABLING A VEHICLE BY WAY OF A PORTABLE WIRELESS DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is divisional of application Ser. No. 13/229,398 filed Sep. 9, 2011, titled "Methods and Systems of Selectively Enabling a Vehicle by Way of a Portable Wireless Device" (now U.S. Pat. No. 9,026,267). The Ser. No. 13/229,398 application was a continuation-in-part of application Ser. No. 12/826,513 filed Jun. 29, 2010, titled "Onboard Starter-Interrupt Device Incorporating Wireless Personal Area Network." The Ser. No. 12/826,513 application was a divisional of application Ser. No. 11/684,186 filed Mar. 9, 2007, titled "Onboard Starter-Interrupt Device Incorporating Wireless Personal Area Network." All the applications noted are incorporated by reference herein as if reproduced in full below.

BACKGROUND

Individuals with low credit scores have difficulty financing purchases, such as purchases of automobiles. To the extent such individuals can find companies to finance automobile purchases, many times the financing is through a "buy here, pay here" automobile dealer where the purchaser makes payments directly at the automobile dealer's location. In many cases, the automobile purchased includes an after-market onboard device, installed by the automobile dealer, which enables the dealer to disable the vehicle in the event payments are not made, or not timely made. In some cases, the onboard device has the ability to determine the location of the automobile and send location information to a data center.

Thus, the onboard device of the related-art is a fairly sophisticated device, which includes electronics for: receiving Global Positioning System (GPS) signals; calculating location; communicating with a data center over a wireless communication network (such as cellular telephone network); and disabling the automobile to which the onboard device is affixed. Of course, the functionality drives up the cost per unit, and the communication functionality further carries wireless communication network access charges.

Any advance which reduces the product cost, or reduces operational costs, of the onboard device would provide a competitive advantage in the marketplace.

BRIEF DESCRIPTION OF THE DRAWINGS

For a detailed description of exemplary embodiments, reference will now be made to the accompanying drawings in which:

FIG. 1 shows a system in accordance with at least some embodiments;

FIG. 2 shows an electrical block diagram of a portable wireless device in accordance with at least some embodiments;

FIG. 3 shows an automobile with a docking station in accordance with at least some embodiments;

FIG. 4 shows a method in accordance with at least some embodiments;

FIG. 5 shows a method in accordance with at least some embodiments; and

FIG. 6 shows a method in accordance with at least some embodiments.

NOTATION AND NOMENCLATURE

Certain terms are used throughout the following description and claims to refer to particular system components. As one skilled in the art will appreciate, different companies may refer to a component by different names. This document does not intend to distinguish between components that differ in name but not function. In the following discussion and in the claims, the terms "including" and "comprising" are used in an open-ended fashion, and thus should be interpreted to mean "including, but not limited to" Also, the term "couple" or "couples" is intended to mean either an indirect or direct connection. Thus, if a first device couples to a second device, that connection may be through a direct connection, or through an indirect connection via other devices and connections.

"Affixed" with respect to an onboard device and a vehicle shall mean that the onboard device is mechanically and electrically coupled to the vehicle such that the onboard device is not physically accessible by an occupant properly seated in the vehicle.

"Portable wireless device" shall mean a handheld device that has the ability to execute third party applications, communicate over a wireless data network, and is not affixed to the vehicle. The fact that a portable wireless device may dock with a docking station while in a vehicle shall not obviate the portable status.

"Proximate", in reference to a portable wireless device and a vehicle, shall mean coupled to the vehicle, within the vehicle, or within two meters of the vehicle.

"Remote" or "remotely", relative to a device or vehicle, shall mean a distance of greater than one kilometer.

DETAILED DESCRIPTION

The following discussion is directed to various embodiments of the invention. Although one or more of these embodiments may be preferred, the embodiments disclosed should not be interpreted, or otherwise used, as limiting the scope of the disclosure or claims. In addition, one skilled in the art will understand that the following description has broad application, and the discussion of any embodiment is meant only to be exemplary of that embodiment, and not intended to intimate that the scope of the disclosure or claims is limited to that embodiment.

The various embodiments are directed to systems and methods of using a portable wireless device, such as the smart phone of the driver, as the primary element in providing location and communication services related to selectively locating and disabling of a vehicle, such as an automobile. By having a significant portion of the functionality implemented on a portable wireless device of a person within the automobile, both the cost of the onboard device, as well as the data transmission costs associated with location and/or disablement, are significantly reduced. In most cases the cost of the onboard device is borne by the consumer purchasing the car, and thus the cost to the consumer may be likewise reduced. FIG. 1 shows a system in accordance with at least some embodiments. In particular, major components of the system comprise data center 100, a portable wireless device 102, a wireless data network 104, and an onboard device 106. Each will be discussed in turn.

The data center 100 may comprise one or more computer systems executing software instructions. In some cases, the one or more computer systems of the data center may all be located at a single location; however, in other cases the computer systems of the data center may be remotely located from

one another, yet functioning as a data center. In a particular embodiment, one or more computer systems of the data center may be “cloud” computer systems provided under contract from a cloud computing service provider, thus the physical location of the computer systems may not be precisely known to the data center operator, or may change daily or even hourly depending on the amount of computing resources used.

In the illustration of FIG. 1, an onboard device **106** is affixed to an automobile **108**. Affixed with respect to an onboard device **108** and an automobile shall mean that the onboard device **108** is mechanically and electrically coupled to the automobile such that the onboard device **108** is not physically accessible by an occupant properly seated in the vehicle. In many cases, the onboard device **106** may reside under or within the dashboard of the automobile. In other cases, the onboard device **106** may be at any suitable location within the automobile, such as in an electrical compartment under the hood, or within the luggage compartment. In a particular embodiment, the onboard device **106** both mechanically and electrically couples to the automobile **108** by way of a connector **110**. That is, connector **110** may provide mechanical support that holds the onboard device **106** in place, and by way of the connector **110** the onboard device **106** may electrically couple to other components of the automobile **108**, such as the onboard computer or starter solenoid. The connector **110** may be an onboard diagnostic (OBD) version two (hereafter just OBD-II) port. Coupling the onboard device **106** to the illustrative OBD-II port thus gives the onboard device **106** the ability to communicate with one or more computer systems of the automobile **108**. In other cases, the connector **110** is a specialty connector within the automobile, such as the starter solenoid relay connector, or fuel pump relay connector.

The onboard device **106** illustrated in FIG. 1 comprises a processor **112** coupled to a memory **114** by way of a bus **116**. The memory **114** stores programs executed by the processor **112**, and in some cases may be the working memory for the processor **112**. For example, the memory **114** may be random access memory (RAM) (e.g., dynamic random access memory (DRAM), flash memory), program-mable read-only memory (PROM), or combinations. While FIG. 1 shows the processor **112** and memory **114** as separate components, in other cases the processor and memory are an integrated component, such as microcontroller. The processor **112** may communicate with sub-systems of the automobile over the connector **110**.

The onboard device **106** further comprises a wireless communication system **118** coupled to the processor **112**. By way of the wireless communication system **118**, programs of the processor **112** may wirelessly communicate with other devices (i.e., radio frequency communication by way of electromagnetic waves propagating through air), as discussed more below. The wireless communication system **118** may take many forms, but has a limited distance over which communication may take place—a short range communication network. In particular, the range of the wireless communication system **118** need not extend beyond the passenger compartment of the automobile, but because the passenger compartment of an automobile has windows and doors, the range may extend beyond the automobile for a relatively short distance (e.g., two meters). The protocol over which the wireless communication system **118** communicates may likewise take many forms. In one embodiment, the wireless communication system **118** implements a Bluetooth communication protocol. Another example is a ZIGBEE® brand network protocol, where the ZIGBEE® trademark is owned by Zigbee

Alliance. Regardless of the type of protocol and range implemented by the wireless communication system **118**, when the onboard device **106** is installed and remotely located from the data center **100** the wireless communication system **118** cannot communicate with the data center **100** without an intervening device in the form of the portable wireless device **102**.

Portable wireless device **102** is a handheld device that has the ability to execute third party applications, communicate over a wireless data network **104**, communicate over the short range communication network (i.e., communicate with the wireless communication system **118** when in range), and is not affixed to the automobile. In some cases, the portable wireless device **102** also places and receives cellular telephone calls. Thus, in some embodiments, the portable wireless device **102** is a “smart phone” possessed by an owner or occupant of the automobile. In most cases, the portable wireless device **102** will be carried by an owner or occupant of the automobile **108**, and thus will be out of communication range with the onboard device **106** at times when the owner or occupant is not proximate to the automobile. However, when the owner or occupant approaches the automobile, or is within the automobile, the portable wireless device **102** may establish communication with the onboard device **106**.

FIG. 2 shows an electrical block diagram of a portable wireless device **102** in accordance with at least some embodiments. In particular, the portable wireless device **102** comprises a processor **200**, memory **204**, graphics controller **206**, display device **208**, global positioning system (GPS) receiver **210**, cellular phone/data transceiver **212**, short range communication transceiver **214**, and battery **216**. The processor **200** is coupled to memory **204**, such as by a bus **202**. The memory **204** stores programs executed by the processor **200**, and in some cases may be the working memory for the processor **200**. In some cases, the memory **204** may be random access memory (RAM) (e.g., dynamic random access memory (DRAM), flash memory). The memory **204** may store programs used by the portable wireless device for operation, such as a mobile operating system (e.g., iOS™ brand mobile operating system from Apple, Inc., or the ANDROID™ brand mobile operating system from Google, Inc.) and original equipment manufacturer (OEM) installed programs (e.g., applications to implement placing and receiving cellular phone calls, or messaging services).

A person who carries the portable wireless device **102** may interface with the various programs executed on the device **102** by way of display device **208**. The display device **208** may be any display device upon which text and/or images may be formed, such as a liquid crystal display (LCD). In some cases, the display device is controlled by graphics controller **206**, but in other cases the graphics controller functionality may be implemented within the processor **200**. Though not specifically shown in FIG. 2, the display device may be overlaid with a transparent touch sensitive device such that the portable wireless device implements “touch screen” functionality.

The illustrative portable wireless device **102** further comprises a GPS receiver **210**. The GPS receiver **210** receives signals from an array of GPS satellites orbiting the earth, and based on timing associated with arrival of those signals, a position can be determined. In some cases, the GPS receiver **210** has sufficient functionality to calculate position, and thus the data passed to processor **200** may be a direct indication of position. In other cases, the functionality to determine position may be shared between the GPS receiver **210** and software executing on the processor **200**. That is, the GPS receiver **210** may receive the plurality of GPS signals and pass the information to a program on the processor **200**, which

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program may then make the determination as to location of the portable wireless device **102**.

Still referring to FIG. 2, the portable wireless device further comprises a cellular phone/data transceiver **212**, over which voice and data transmission may take place. The transceiver **212** thus implements a wireless communication system and/or protocol (i.e., radio frequency communication by way of electromagnetic waves propagating through air). Any suitable communication protocol may be implemented by the transceiver **212**, such as Global System for Mobile Communications (GSM) compliant protocol, a General Packet Radio Service (GPRS) compliant protocol, or a Personal Communications Service (PCS) compliant system. While it is contemplated that in most cases the transceiver **212** will employ both voice and data communications, in some embodiments only a data communication system is implemented (e.g., an IPAD™ brand product available from Apple, Inc.). That is, in some cases the portable wireless device **102** does not provide voice services.

Still referring to FIG. 2, illustrative portable wireless device **102** further comprises a short range communication transceiver **214**. By way of the short range communication transceiver **214**, programs executed by the processor **200** may communicate with other devices, such as the onboard device **106**. The short range communication transceiver **214** may take many forms, but has a limited distance over which communication may take place. In a particular embodiment, the transceiver **214** is a wireless transceiver (i.e., radio frequency communication by way of electromagnetic waves propagating through air), and need not have a range larger than the passenger compartment of the automobile **108** to which the onboard device **106** is affixed. Because the passenger compartment of an automobile has windows and doors, the portable wireless device **102** may establish communication when in close proximity to the automobile **108** (e.g., within two meters). The protocol over which the short range communication transceiver **214** communicates may take many forms, but will be compatible with the protocol of the wireless communication system **118** of the onboard device **106**. Thus, the short range communication transceiver **214** may implement any suitable system, such as a Bluetooth communication protocol, or a ZIGBEE® brand communication protocol.

Returning again to FIG. 1, in order for the onboard device **106** to have the ability to reliably establish communication with the data center **100**, in accordance with various embodiments the portable wireless device **102** is considered a “key” to the car. That is, in one embodiment onboard device **106** is configured to disable the automobile **108** at any time the portable wireless device **102** is not communicatively coupled to the onboard device **106** by way of the wireless communication system **118**, and the onboard device **106** is configured to enable the automobile **108** at any time the portable wireless device **102** is communicatively coupled to the onboard device **106** by way of the wireless communication system **118**.

Disabling and enabling of the automobile **108** based on proximity of the portable wireless device **102** may take many forms. In some embodiments, the onboard device **106** is mechanically and electrically coupled to connector **110** in the form of the OBD-II port as discussed above. When connected to the OBD-II port, the onboard device **106** may communicate with one or more computer systems of the automobile **108**, and thus may disable the automobile by any suitable technique, such as disabling the ability to crank the engine, disabling the spark ignition system, disabling the fuel system, or a combination. An onboard device **106** configured to couple to the OBD-II port may also have the ability to read or

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determine data associated with the vehicle, such as determining the identity of the vehicle (e.g., by reading the VIN number).

In other embodiments, the onboard device **106** may be a relay replacement device. For example, a starter relay is a device within an automobile that, when activated, provides electrical current to the solenoid of the starter. The onboard device **106** in the form a starter relay replacement device may thus act as an operational starter relay when the portable wireless device **102** is communicatively coupled, but in the event communication is lost with the portable wireless device **102** the onboard device **106** may not provide current to the solenoid in spite of a command to do so. Thus, connector **110** may be a relay connector. In yet still other cases, the onboard device **106** may be a relay replacement device for any system that could disable the vehicle (e.g., either prevents the motor from starting, or prevents the motor from continuing to operate).

The portable wireless device **102** and onboard device **106** also enable further functionality regarding the data center **100**. In particular, the data center **100** (e.g., at the behest of a lien holder on the automobile) may periodically need to determine the location of the automobile **108** (e.g., to ensure the automobile has not been moved out of state). In accordance with the various embodiments, location services are based on the portable wireless device **102**. That is, in accordance with at least some embodiments determining the location of the automobile **108** may involve the data center **100** communicating with the portable wireless device **102** by way of the wireless data network **104**. It is noted that reference to communication with the portable wireless device **102** by way of the wireless data network **104** shall not be read to require that the data center **100** wirelessly couple to the data network **104**. The communication by the data center **100** to the portable wireless device **102** may thus request an indication of location. The portable wireless device **102**, in turn, may establish whether the device **102** is communicatively coupled to the onboard device **106**. If the portable wireless device **102** is not communicatively coupled to the onboard device **106**, the portable wireless device **102** may notify the data center **100**, and/or wait until communication is established with the onboard device **106**.

Assuming the portable wireless device is or becomes communicatively coupled with the onboard device **106**, the wireless device **102** then activates its GPS receiver **210** to receive signals from a plurality of GPS satellites (illustrated by satellite **130**) and determine location. Once a location is established, the location information is sent to the data center **100** over the wireless data network **104**. Thus, location of the automobile may be determined in spite of the fact the onboard device **106** does not have the capability to determine location.

In yet still further embodiments, the data center **100** may periodically need to disable the automobile **108**. For example, in the event a payment is missed, or some other contractual obligation is breached (e.g., automobile moved to a non-approved location) the automobile **108** may be disabled. As with the location services, in accordance with the various embodiments disablement services are based on the portable wireless device **102**. That is, in accordance with at least some embodiments disabling the automobile **108** may involve the data center **100** communicating with the portable wireless device **102** by way of the wireless data network **104**. The portable wireless device **102**, in turn, may establish whether the device **102** is communicatively coupled to the onboard device **106**. If the portable wireless device **102** is not communicatively coupled to the onboard device **106**, the portable

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wireless device **102** may notify the data center **100**, and/or wait until communication is established with the onboard device **106**.

Assuming the portable wireless device is or becomes communicatively coupled with the onboard device **106**, the portable wireless device **102** then sends a command to the onboard device **106**. The onboard device, in turn, disables the automobile. Thus, the automobile may be disabled in spite of the fact the onboard device **106** does not have the capability to communicate with the data center **100** over the wireless data network **104**.

In accordance with yet still further embodiments, the data center **100** may periodically need to communicate with the owner or occupant of the automobile **108**. For example, in the event a payment due date is approaching, or the automobile is approaching a contractual boundary, the data center **100** may send a message to the owner or occupant. In accordance with at least some embodiments, sending a message by the data center **100** may involve the data center **100** communicating with the portable wireless device **102** by way of the wireless data network **104**. The portable wireless device **102**, in turn, may display the message on the display device **208**. The message may take many forms. In some cases the message is text message (e.g., short messaging service (SMS) text communication). In yet still other embodiments, the message may take the form of series of TCP/IP packets exchanged between a program executing on the portable wireless device **102** and the computer systems of the data center **100**.

The various embodiments discussed to this point have been based on embodiments where the portable wireless device **102** wirelessly couples to the onboard device **106**. However, in yet still further embodiments the portable wireless device may couple to a docking station within the automobile, and further communicatively couple with the onboard device **106** by way of one or more conductors. FIG. **3** shows a block diagram of further embodiments that utilize a docking station. In particular, FIG. **3** shows a docking station **300** mechanically coupled to the automobile **108**. The docking station may take many forms depending on the nature of the portable wireless device **102**. For example, for a portable wireless device **102** in the form of an IPHONE™ brand product (produced by Apple, Inc. of Cupertino, Calif.), the docking station **300** may comprise the proprietary IPHONE™ connector along with one or more mechanism to physically hold the IPHONE™. Thus, the docking station **300** may both mechanically couple the portable wireless device **102** to the automobile, and electrically couple the portable wireless device **102** to the onboard device **106**. In some cases, one or more conductors **302** may couple between the docking station **300** and the onboard device **106**, thus establishing a communication network. The conductors may be either electrical or optical conductors. It is noted again, however, that coupling the portable wireless device **102** to a docking station **300** when the device **102** is within the automobile shall not, for purposes of the claims, obviate the portable status of the device **102**.

FIG. **4** shows a method in accordance with at least some embodiments, some of which may be implemented in software executed at the data center and/or the portable wireless device. In particular, the method starts (block **400**) and comprises: enabling a vehicle when a portable wireless device is communicatively coupled to an onboard device by way of a first communication network, the enabling by the onboard device coupled to the vehicle (block **402**); sending an indication of location of the vehicle to a data center (block **404**); and disabling the vehicle when the portable wireless device is no longer communicatively coupled to the onboard device

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(block **412**). The sending (again block **404**) may comprise: receiving global positioning system (GPS) signals by the portable wireless device, the portable wireless device operatively coupled to a second communication network (block **406**); establishing that the portable wireless device is proximate to the vehicle, the establishing by the portable wireless device (block **408**); and sending an indication of location to the data center, the sending by the portable wireless device by way of the second communication network (block **410**). Thereafter, the method ends (block **414**).

FIG. **5** shows a method in accordance with at least some embodiments, some of which may be implemented in software executed at the data center and/or the portable wireless device. In particular, the method starts (block **500**) and comprises disabling the vehicle during periods of time when the portable wireless device is proximate the vehicle (block **502**). In some cases, the disabling is by: sending a message from the data center to the portable wireless device (block **504**); sending a command to the onboard device by the portable wireless device, the sending the command responsive to the message from the data center (block **506**); and disabling the vehicle by the onboard device responsive to the command (block **508**). Thereafter, the method ends (block **510**).

FIG. **6** shows a method in accordance with at least some embodiments, some of which may be implemented in software executed at the data center and/or the portable wireless device. In particular, the method starts (block **600**) and comprises: establishing a first communication between a portable wireless device proximate a vehicle and an onboard device affixed to the vehicle, the first communication by way of a first communication network (block **602**); establishing a second communication between the portable wireless device and a data center remotely located from the portable wireless device and the vehicle, the second communication by way of a second communication network distinct from the first communication network (block **604**); receiving a message by the portable wireless device from the data center, the message received over the second communication network (block **606**); enabling the vehicle responsive to the message indicating enablement, the enabling by the portable wireless device sending a command to the onboard device over the first communication network (block **608**); and disabling the vehicle responsive to the message indicating disablement, the disabling by the portable wireless device sending a command to the onboard device over the first communication network (block **610**). Thereafter, the method ends (block **612**).

In the specification and claims, certain components may be described in terms of algorithms and/or steps performed by a software application that may be provided on a non-transitory storage medium (i.e., other than a carrier wave or a signal propagating along a conductor). The various embodiments also relate to a system for performing various steps and operations as described herein. This system may be a specially-constructed device such as an electronic device, or it may include one or more general-purpose computers that can follow software instructions to perform the steps described herein. Multiple computers can be networked to perform such functions. Software instructions may be stored in any computer readable storage medium, such as for example, magnetic or optical disks, cards, memory, and the like.

References to “one embodiment”, “an embodiment”, “a particular embodiment” indicate that a particular element or characteristic is included in at least one embodiment of the invention. Although the phrases “in one embodiment”, “an embodiment”, and “a particular embodiment” may appear in various places, these do not necessarily refer to the same embodiment.

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The above discussion is meant to be illustrative of the principles and various embodiments of the present invention. Numerous variations and modifications will become apparent to those skilled in the art once the above disclosure is fully appreciated. For example, the onboard device, particularly in the relay embodiments, may be just a relay operated at the behest of a digital output of the wireless communication system **118**, thus omitting the processor **112** and memory **114**. It is intended that the following claims be interpreted to embrace all such variations and modifications.

What is claimed is:

1. A system comprising:

a data center;

a portable wireless device comprising:

a processor;

a memory coupled to the processor;

a first wireless communication circuit coupled to the processor, the first wireless communication circuit configured to communicate using a first communication protocol;

a second wireless communication circuit coupled to the processor, the second wireless communication circuit distinct from the first wireless communication circuit, the second wireless communication circuit configured to communicate using a second communication protocol distinct from the first communication protocol;

wherein the portable wireless device is communicatively coupled to the data center by way of the second communication protocol;

an onboard device affixed to a vehicle, the onboard device comprising:

a connector coupled to a mating connector of the vehicle;

a circuit electrically coupled to the connector and the circuit configured to disable the vehicle; and

a third wireless communication circuit configured to communicate using the first communication protocol; wherein the onboard device communicates to the data center only by way of the first communication protocol through the portable wireless device;

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wherein the memory stores a program that, when executed by the processor of the portable wireless device causes the processor to:

send a command to disable the vehicle to the onboard device by way of the first communication protocol;

send a command to enable the vehicle to the onboard device by way of the first communication protocol; and

send an indication of location of the vehicle to the data center over the second communication protocol.

2. The system of claim **1** wherein when the processor of the portable wireless device sends the command to disable, the program further causes the processor to:

receive a message from the data center over the second communication protocol; and responsive to the message send the command to disable the vehicle to the onboard device.

3. The system of claim **1** wherein when the processor of the portable wireless device sends the command to enable, the program further causes the processor to:

receive a message from the data center over the second communication protocol; and responsive to the message send the command to enable the vehicle to the onboard device.

4. The system of claim **1** wherein the program further causes the processor to:

receive a message from the data center over the second communication protocol; and

display the message on a display device of the portable wireless device.

5. The system of claim **1** wherein the program further causes the processor to:

accept data regarding payment for continued operation of the vehicle; and

send the data regarding payment to the data center.

6. The system of claim **1** wherein the onboard device is configured to disable the starter of the vehicle.

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